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Are groups better planners than individuals? An experimental analysis ☆

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ABSTRACT

We present the results of an experiment comparing group and individual planning in the domain of lifecycle consumption/saving decisions. Individual decision making is compared to two group treatments, which differ based on the presence of a rematching rule. We find that individuals and groups differ in how they solve the intertemporal consumption problem, but not in how they improve their consumption planning within a sequence. Individuals' performance improves across sequences, groups without rematching perform approximately the same, while groups with rematching do significantly worse. Our main finding is that while groups perform better than individuals in the first sequence, this difference seems to disappear in the second lifecycle. Results show that in the second sequence groups in the rematching treatment deviate substantially more from optimum than groups that are left stable across sequences.

1. Introduction

Models of intertemporal consumption are typically presented as an exercise of maximization of lifetime utility, subject to a budget constraint. Traditionally these models assume that intertemporal planning is carried out by individuals. However, everyday, decisions that have consequences over time, particularly those that involve devising intertemporal consumption plans, are made by groups of different forms and nature (e.g. committees, households, boards of directors, groups of advisors and so on). Many experiments, particularly in game theory, report evidence of the difference between groups and individuals. Groups can coordinate more efficiently (Feri, Irlenbusch, and Sutter, 2010) and play some games in a significantly different way (stag-hunt game, Charness and Jackson, 2007). Also, they are able to develop strategic thinking faster than individuals, outperforming them especially in cases where learning is difficult (Cooper and Kagel, 2005). Groups are strategically more rational in ultimatum games (Bornstein and Yaniv, 1998), normal-form games (Sutter, Czermak, and Feri, 2010), and in cognitively demanding tasks (such as beauty-contest games, (Kocher and Sutter, 2005)). They learn faster (see also Maciejovsky et al., 2010), outperforming individuals when interacting directly with them (although the experience acquired through repetition allows individuals to partly compensate this difference, Kocher and Sutter (2005, p. 220)). As summarized by Charness and Sutter (2012), groups are more likely to make choices compatible with game-theoretic rationality, while individuals are more prone to biases and may seek group participation as a way of protecting themselves from the consequences of irrationality.[1] However, groups are not always clearly better than individuals. There are environments (games with unique equilibria) in which individual decision making is more efficient and others (games with multiple equilibria) where groups are able to achieve better welfare results.[2] In the domain of static choices, Bone, Hey, and Suckling (1999) and Bateman and Munro (2005) report that there is no significant difference between groups and individuals with respect to their consistency with Expected Utility. In lottery-choice experiments Baker, Laury, and Williams (2008), Shupp and Williams (2008), and Masclet et al. (2009) find that groups are more risk averse than individuals, while results reported by Zhang and Casari (2012) show that group choices are closer to risk neutrality and more coherent than individual choices. An overall review of the existing literature shows that groups do not appear to be unequivocally better than individuals. Instead, it seems that the specific context and nature of the task may play an important role in the performance of both type of agents.

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[1] Charness and Sutter (2012, p. 158).
[2] Charness and Sutter (2012, p. 158, 173).

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This paper contributes to the literature on this topic by gathering evidence that compares groups and individuals, in the domain of lifecycle consumption/saving decisions. In particular, we compare individual decisions with those of groups, whose members are either rematched with other people in the second lifecycle or remain stable for both sequences. Our findings are as follows: 1) individuals and groups differ in how they solve the intertemporal consumption problem, however, there is no difference in how they improve their planning within a sequence; 2) in the first lifecycle groups deviate significantly less from optimum, compared to individuals; 3) while individuals improve their performance across sequences, groups are unable to do so; 4) in the second sequence, the difference between individuals and groups is not significant. Groups in the rematching treatment deviate from optimum more than groups without rematching.

2. Related literature

Empirical evidence has shown how dynamic optimization problems involve computational difficulties that agents are not always equipped to solve optimally. For example, analyses on household and aggregate data demonstrate that people do not save enough (Browning and Lusardi, 1996). Similarly, experimental results suggest that people are very different in how they solve this class of problems and in how they react to changes in the decision making environment. Carbone and Hey (2004) present an experiment on intertemporal planning in a lifecycle context with risky income. They find that their participants do not optimize and tend to overreact to changes in employment/unemployment status, also showing that subjects differ substantially in their actual planning horizon. Ballinger, Palumbo, and Wilcox (2003) and Brown, Chua, and Camerer (2009) look at intertemporal consumption experiments focussed on "intergenerational" social learning. Both studies find that although subjects do not optimize, social learning seems to constitute an important force, driving planning closer to optimization. Carbone and Duffy (2014) have recently examined social learning in a lifecycle consumption/savings task as "contemporaneous imitation" rather than intergenerational imitation, they find that when social information on average consumption choices is provided, subject consumption and saving plans depart further from the optimal path relative to an environment without social information.

To date few studies have been done that compare the behavior of individuals and groups in intertemporal contexts. Gillet, Schram, and Sonnemans (2009) study an intertemporal choice problem of exploiting a common pool. They find that 1) groups make qualitatively better decisions than individuals when there is no competition with other players in an intertemporal common pool environment; 2) in an environment with multiple players, groups deciding by majority rule act more competitively than individuals, while unanimous groups become more competitive with repetition. In a more recent study on dynamic choices Denant-Boemont, Diecidue, and l'Haridon (2013) present a laboratory experiment on collective time preferences based on elicitation of indifference values. The experiment tests impatience, stationarity, age independence and dynamic consistency in individual and group treatments. Their main finding is that individuals are impatient and deviate more from consistent behavior while groups are more patient and make more consistent decisions.

To our knowledge there have not been any attempts made to compare the behavior of individuals and groups in an intertemporal consumption context specifically. In our experiment we use three treatments, one for individual planning and the other two for groups. The critical difference between the two group treatments is the presence of the rematching feature. The creation of new groups in the second sequence, provides a way of additionally testing the extent to which subsequent performance is affected by the stability of the decision maker.

3. Theory

This study considers an agent living for a discrete number of periods (T) and having intertemporal preferences represented by the discounted utility model with a discount rate equal to zero. In each period, she receives utility from consumption; utility is assumed to have a functional form of the CARA type:

$$U(c) = \left(k - \frac{e^{-\rho c}}{\rho}\right)\alpha,$$

where c is consumption, α and k are scaling factors. The objective is then to maximize the expected lifetime utility, that is[3]

$$\max E_t\left[\sum_{t=1}^{T}\beta U(c_t)\right] \quad (1)$$

subject to

$$w_{t+1} = a_{t+1} + y = (1+r)(w_t - c_t) + y$$

where w is available wealth, a represents available assets or savings at the beginning of period $t + 1$ and y is income. In each period of her lifecycle, the agent receives either a high or a low income, with probabilities $p = q = 0.5$. The rate of return is known and held fixed during the lifecycle. Also, borrowing is not allowed, that is, wealth must always be greater or at most equal to zero. Finally, the agent has no bequest motives, that is, any savings are lost after the last period (T). The problem is then to choose the sequence of consumption (from period 1 to period T) that maximizes (1).

The standard procedure to solve this kind of problems is to use dynamic programming, through backward induction. The Bellman equation of the problem has been determined as

$$V_t(w_t) = U(c_t^*) + E\left[V_{t+1}(w_{t+1}^*)\right] \quad (2)$$

where V_t is the value function, w_t represents available wealth and E is the expectation operator.[4] Equation (2) may also be expressed as

$$V_t(w_t) = U(c_t^*) + \left[\frac{1}{2}V_{t+1}\left(w_{t+1}^{*L}\right) + \frac{1}{2}V_{t+1}\left(w_{t+1}^{*H}\right)\right] \quad (3)$$

where

$$w_{t+1}^{*L} = (1+r)(w_t - c_t^*) + y^L$$
$$w_{t+1}^{*H} = (1+r)(w_t - c_t^*) + y^H.$$

In other terms, the expectation is resolved by considering the two possible events: low income, y^L, and high income, y^H. Wealth in period $t+1$ is optimal because it is determined by the (optimal) consumption choice in t. The value function establishes a recursive relation between current and future decisions.

In the specific case of this study, some restrictions have been imposed on variables. In particular, as anticipated, borrowing is not allowed ($w_t \geq 0$) and all variables are rounded to the nearest integer. For this reason a numerical solution of the problem had to be computed. Fig. 1 shows an example of an optimal solution determined by the Maple optimization program.

4. Experimental design

In order to investigate the difference between individual and group planning within the intertemporal consumption framework, an experiment composed of three treatments has been designed.

In each session participants played two independent sequences of fifteen periods each. The final payoff was calculated on the results of

[3] Having set the discount rate equal to zero, β equals 1, so the same can be expressed by: $E(U(c_t) + U(c_{t+1}) + \cdots + U(T))$.

[4] Starred variables indicate optimal choices.